Energy system analysis at SINTEF Energy Research

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Overview of talk

- Introduction to SINTEF
- Planning of Distribution Systems with Multiple Energy Carriers
- TRANSES - Alternatives for the Transition to Sustainable Energy Services in Northern Europe

- *Multi-area Power Market Simulator EMPS*
- *Utilisation of transmission system capacity*
- *Integration of local energy sources by power electronic converters*

The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology

Gloshaugen Campus, Trondheim

SINTEF and NTNU (The Norwegian University of Science & Technology)

Employees:

NTNU	3.300
Scientific	1.600
SINTEF	1.700
Scientific	1.100
Students	20.000
Engineering	8.000

SINTEF's Research Divisions

SINTEF Health Research
Tonje Hamar
Includes former:
SINTEF Unimed

SINTEF ICT
Aage J. Thunem
Includes former:
SINTEF Applied Mathematics
SINTEF Electronics and Cybernetics
SINTEF Telecom and Informatics

SINTEF Marine
Oddvar Aam
Includes:
SINTEF Fisheries and Aquaculture
MARINTEK
Marine Environmental Technology

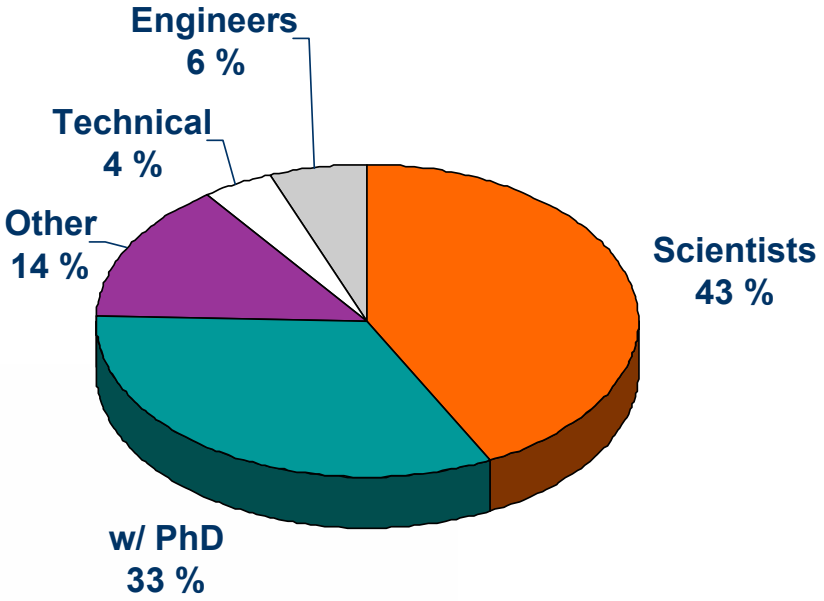
SINTEF Materials and Chemistry
Unni Steinsmo
Includes former:
SINTEF Materials Technology
SINTEF Applied Chemistry

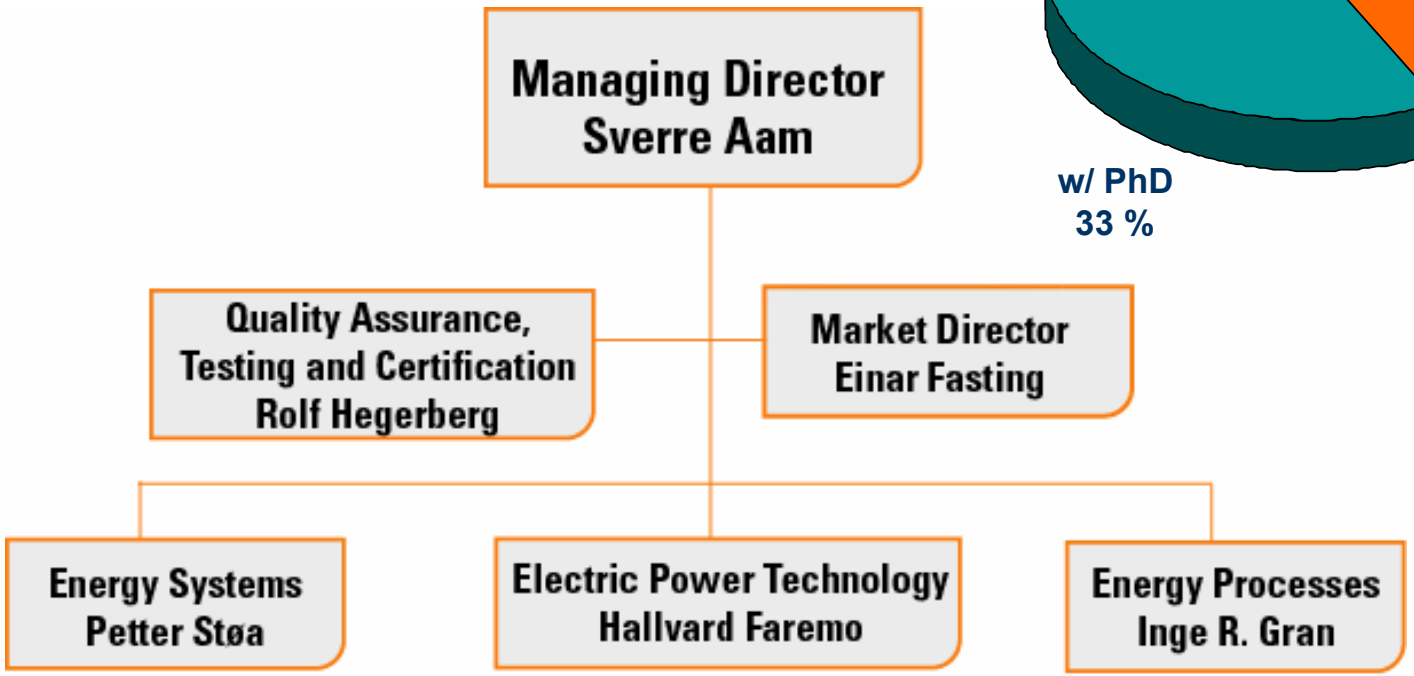
SINTEF Oil and Energy
Sverre Aam
Includes:
SINTEF Petroleum Research
SINTEF Energy Research
SINTEF Solutions Oil and Gas

SINTEF Technology and Society
Tor Ulleberg
Includes:
SINTEF Industrial Management
SINTEF Civil and Environmental Engineering
SINTEF Solutions Public Sector

SINTEF Energy Reseach Organisation

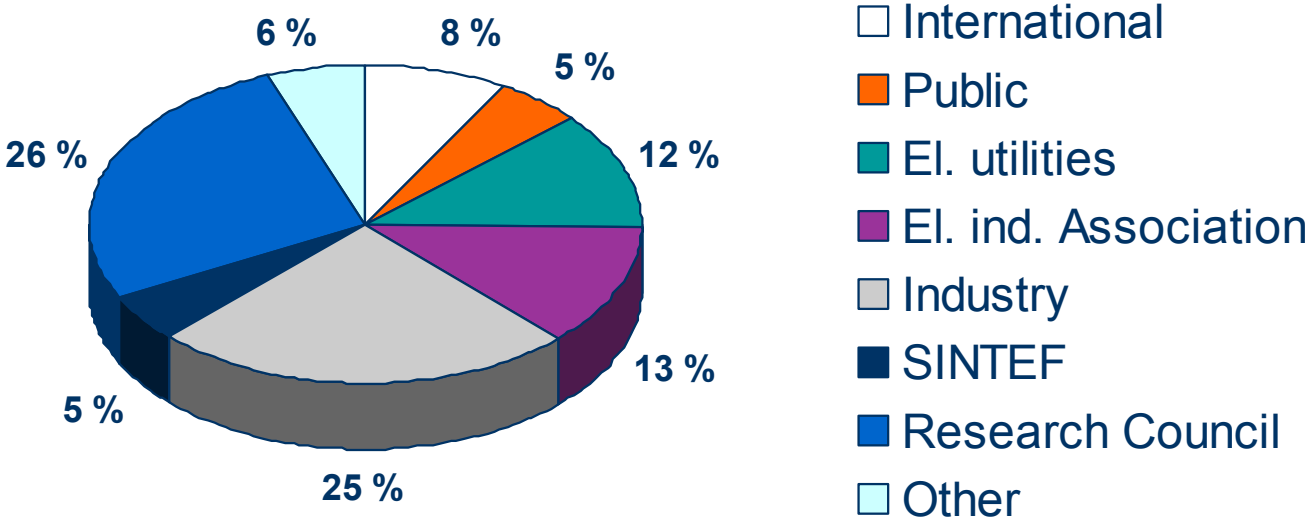
- Number of employees 2003: 188





SINTEF Energy Reseach

- **Income 2003: 27 million USD**



SINTEF Energy Reseach

Areas of expertise

- Electric supply system planning, operation and maintenance
- Combustion
- Gas and LNG technology
- CO_2-technology in refrigeration and heat pumps
- Cable technology
- Energy system analysis

Growth areas

- Deregulated and extended energy markets
- Hydrogen technology
- Sub sea oil- and gas production technology
- Converters
- Integration of renewable energy
- Energy related to industrial processes

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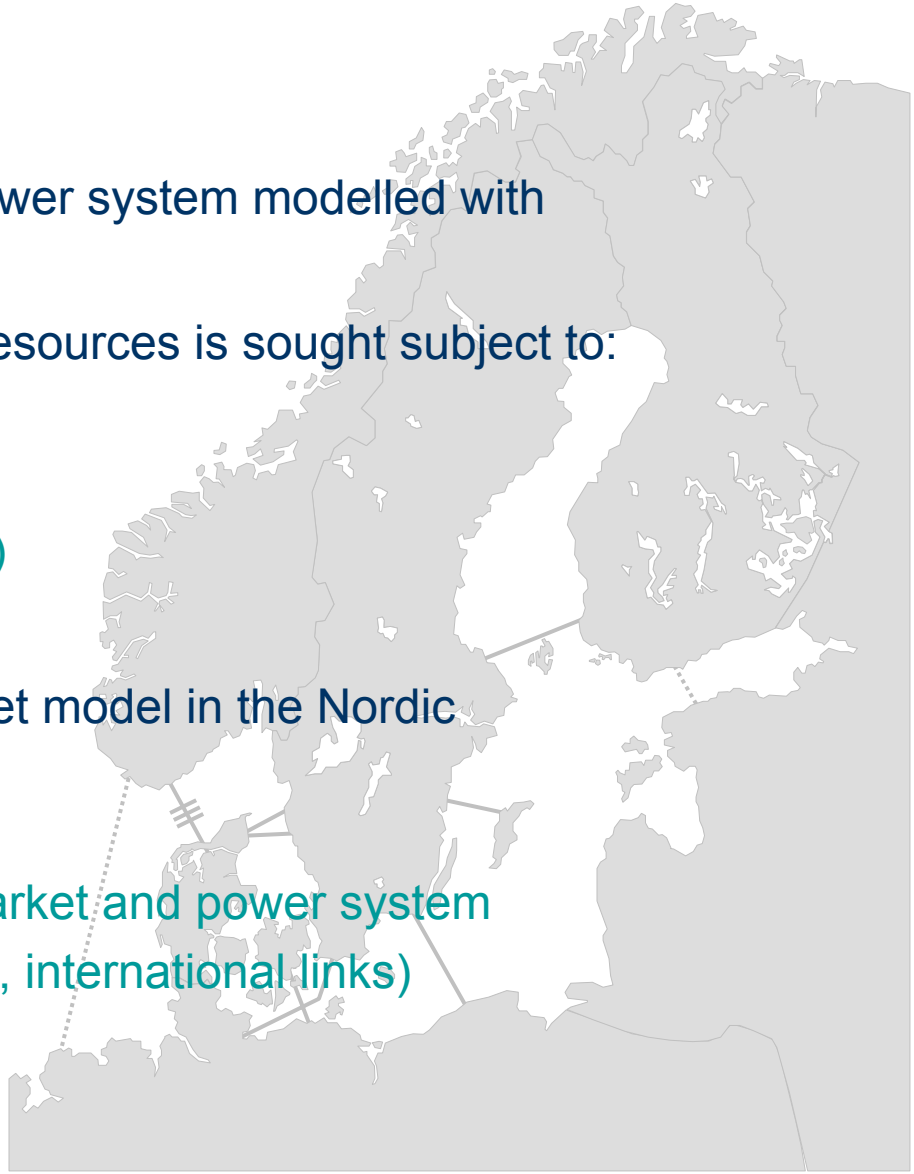
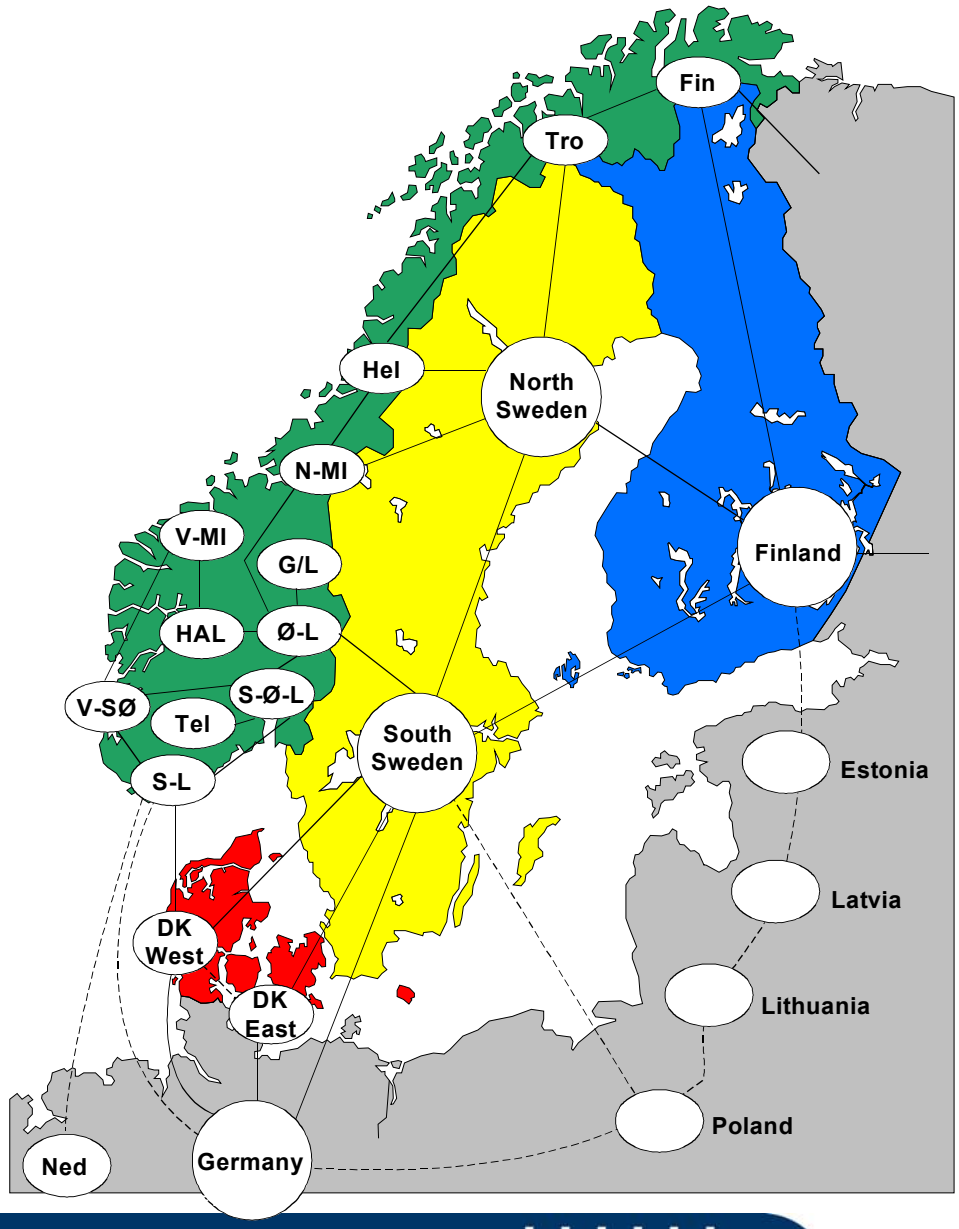
The Multi-area Power Market Simulator (EMPS)

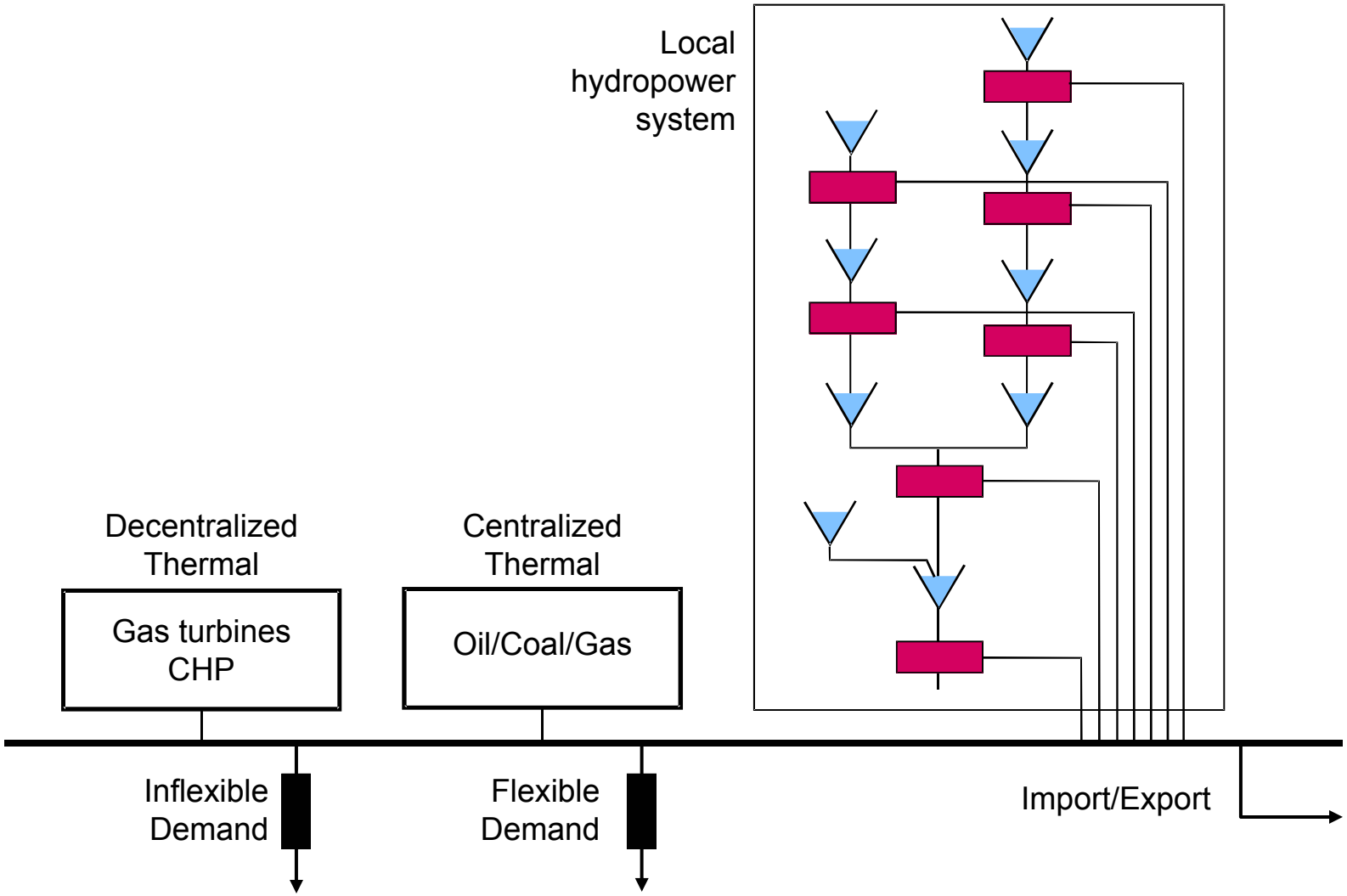
- A process-oriented model
- Different elements of the electrical power system modelled with their capacities and costs
- Optimal long-term utilization of total resources is sought subject to:
  - future inflow (stochastic)
  - thermal-based generation
  - demand (temperature dependent)
  - spot-type market options
- Probably the most used energy market model in the Nordic countries
  - Market price forecasting
  - Studies of the electrical power market and power system
  - Expansion planning (major plants, international links)
  - Generation scheduling



The Nordic electricity market as represented in the EMPS model



Single-area model



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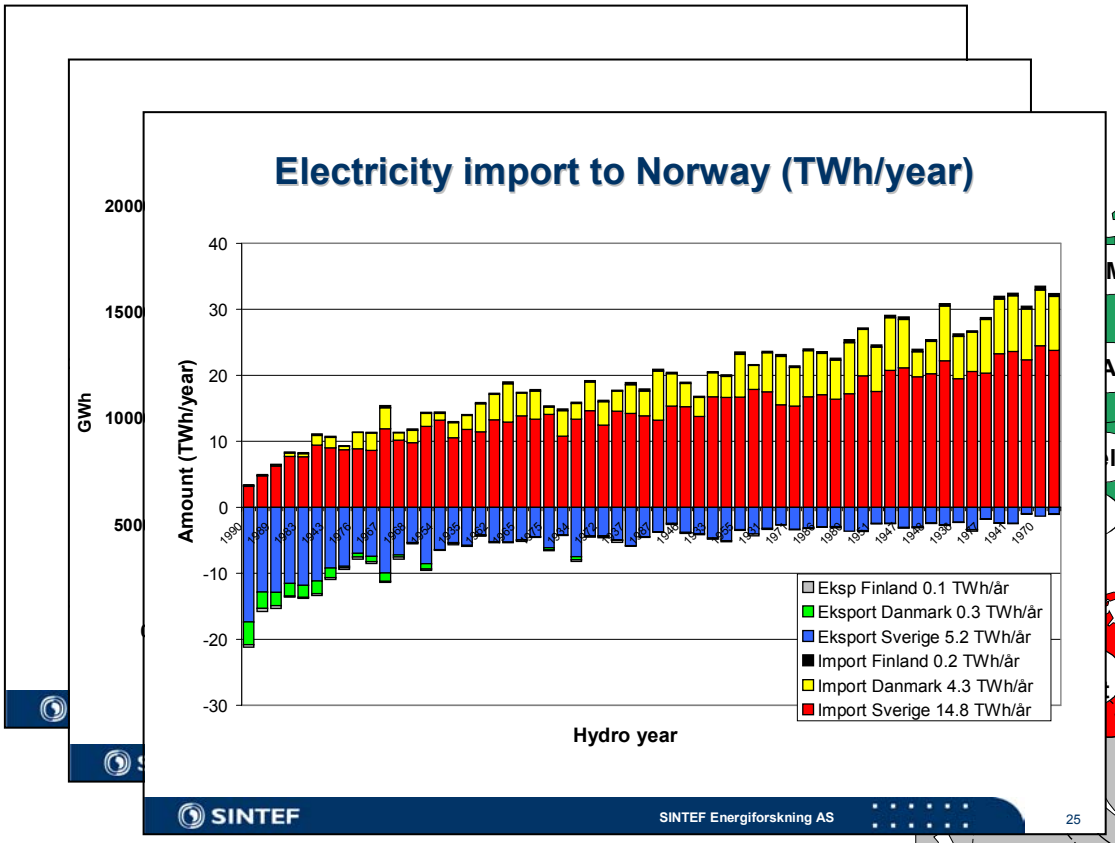
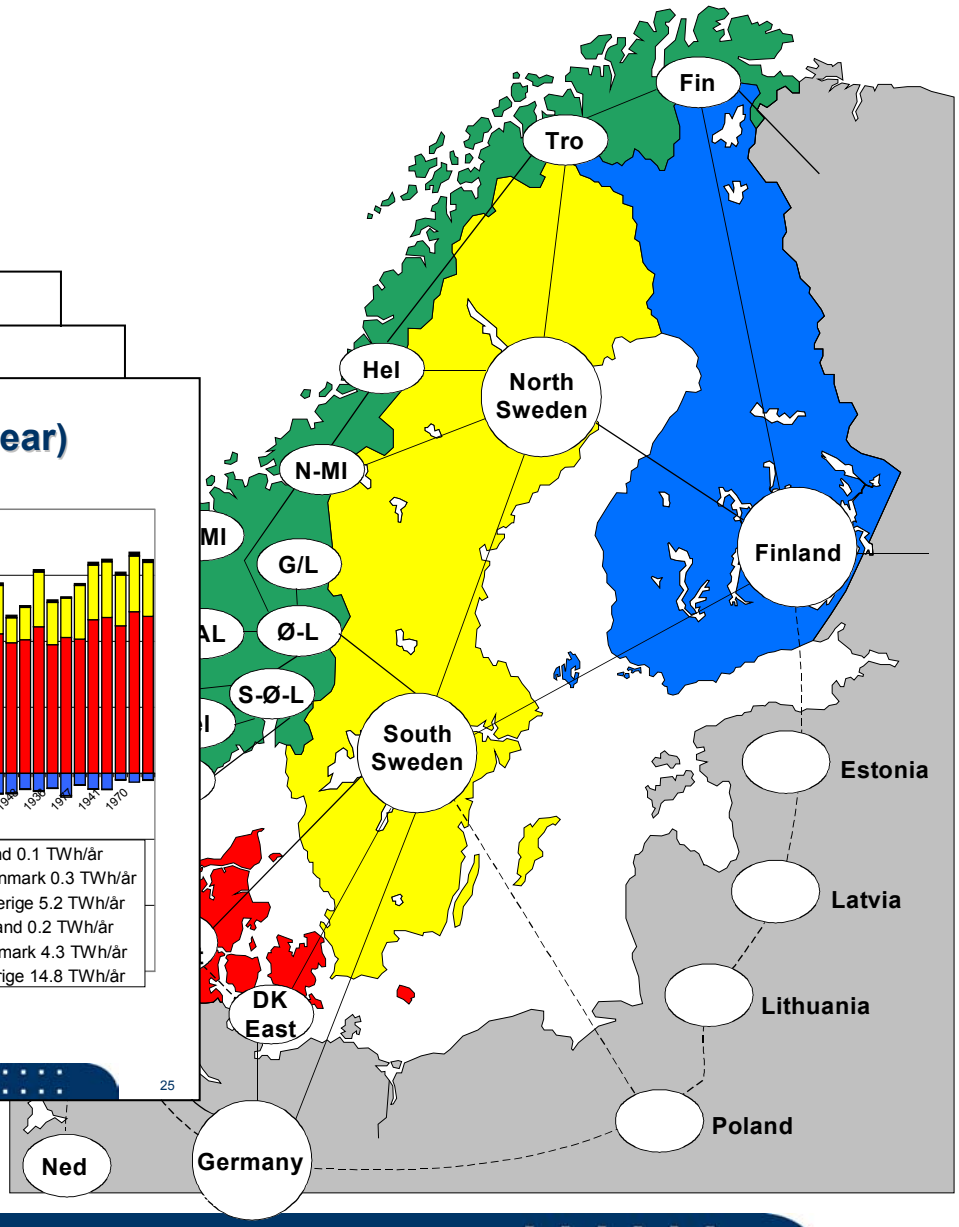
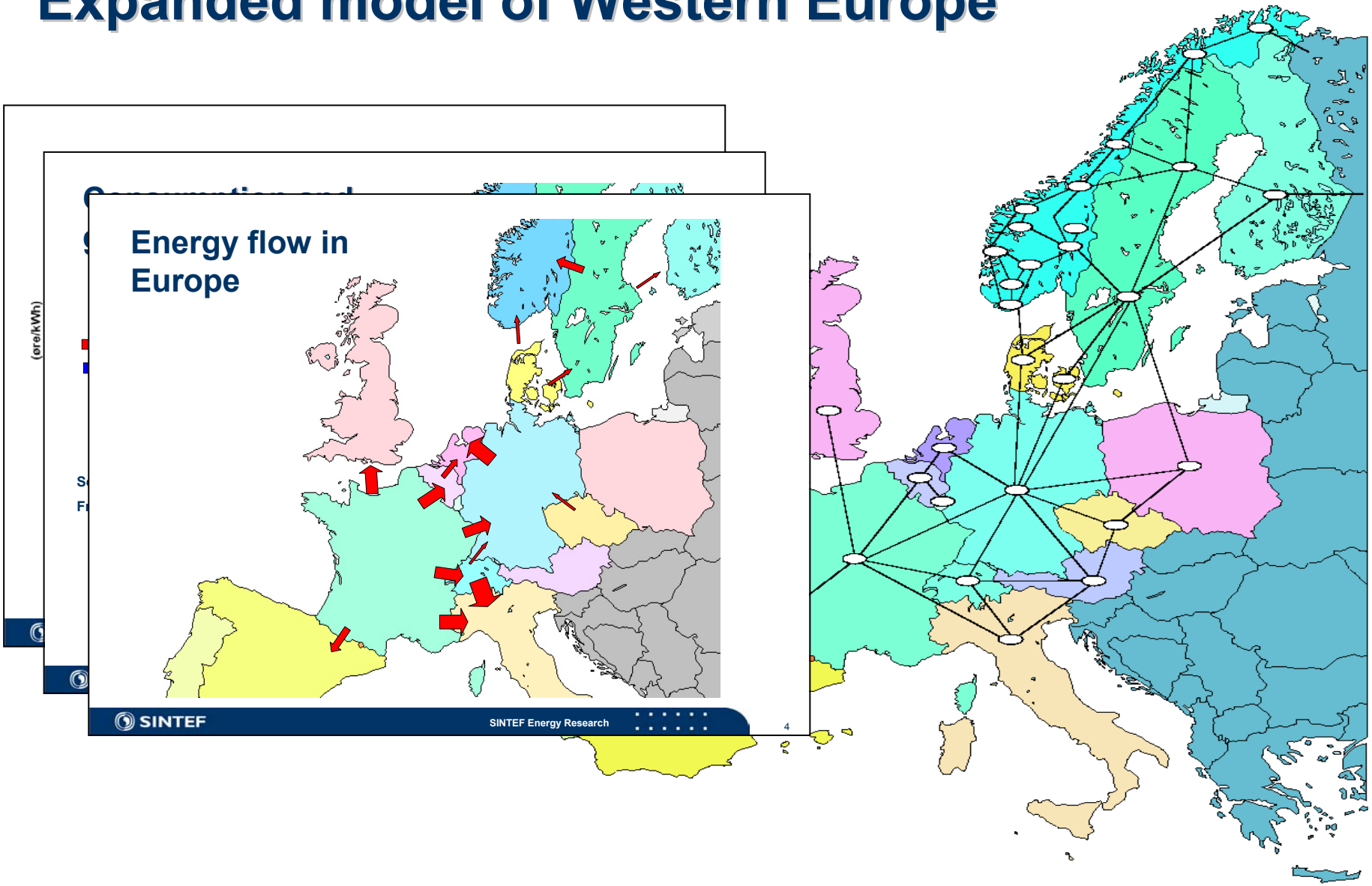




Expanded model of Western Europe

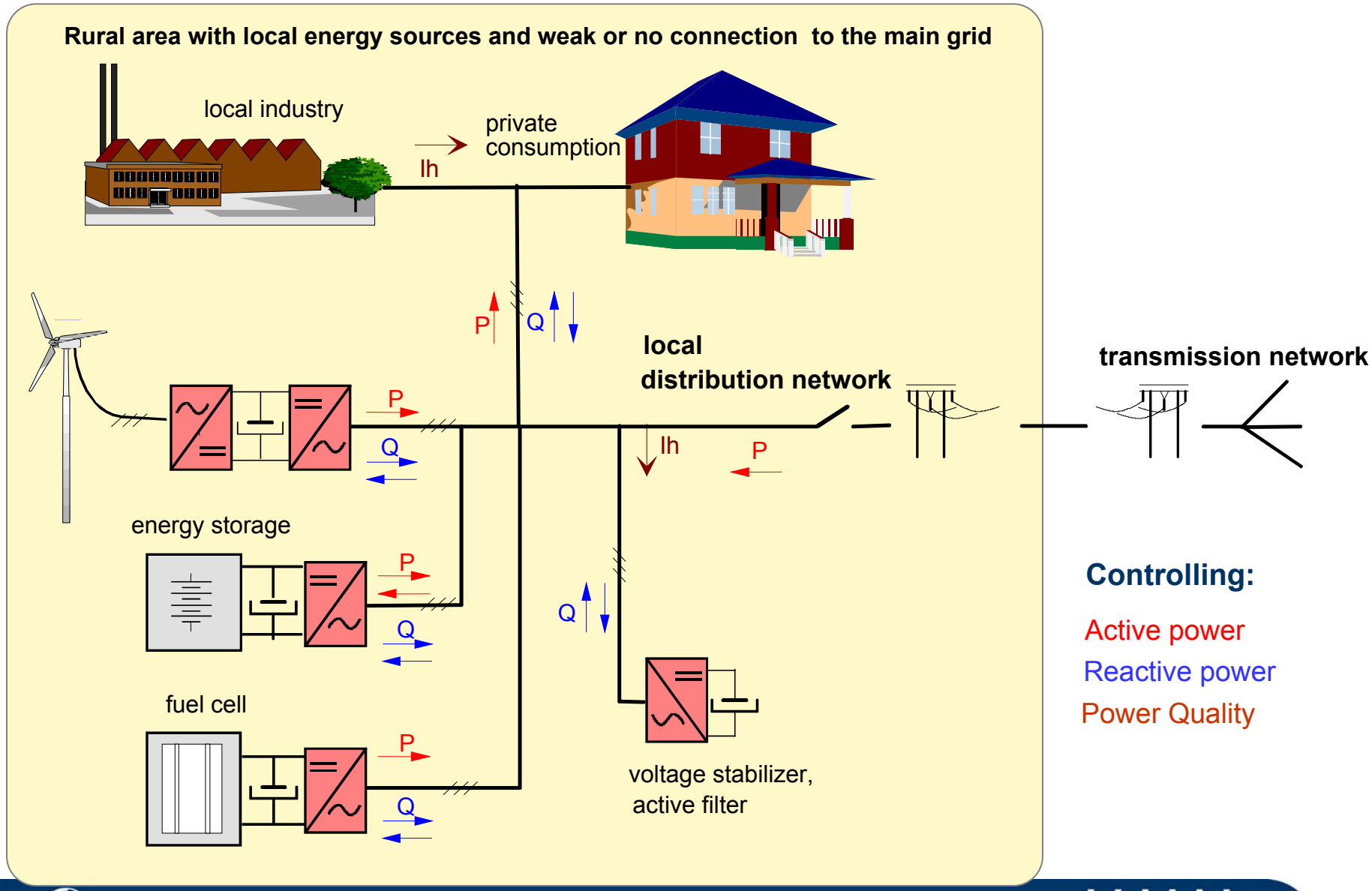


Increased utilisation of transmission system

Focus areas and project activities:

- *System control and operation:* Application and development of new control concepts and monitoring devices for stability enhancement.
- *Power system security:* Development of probabilistic methods for security assessment and determination of power transfer limits.
- *Power markets:* New methods and tools for zonal (Elspot) pricing, utilizing power flow information and optimisation techniques.

Integration of local energy sources by power electronics



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